

TRACE MONITORING OF NEW AND EMERGING POLLUTANTS VIA MICROSCALE MEMBRANE EXTRACTION TECHNIQUES

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In recent times, increasing amounts of everyday consumer products have found their way into our water supplies. Unused medications, fluorinated surfactants that make our clothes stain and water resistant, pesticides, lotions and makeup all contain these “emerging” pollutants that are now being found in trace quantities in water. Limited data exists on the toxicology of these compounds but what is available suggests that these compounds may have toxic effects on human as well as wildlife. Since they are present in trace amounts, their detection is difficult and so techniques must be developed that allow for their extraction and concentration.

Typical methods currently in use include solid phase extraction (SPE) in conjunction with LC/MS/MS, LC/ESI/MS or GC/MS. SPE is a time consuming, costly procedure that requires the use of substantial amounts of organic solvents. SPE cartridges are expensive and the procedure may involve several washings and elutions with an organic solvent, drying with an inert gas such as helium and then reconstitution. Membrane extraction on the other hand requires only microlitres of solvent, is inexpensive, and can be done in relatively short times. Another advantage of membrane extraction is the ability to interface directly with instruments such as GC, HPLC or AAS. This brings with it, the advantage of facilitating real time monitoring which allows for speedier responses to anomalies and hence better management of our resources.

Of these emerging pollutants, pharmaceuticals are receiving increased interest in recent times since many are specific biological toxins. Antibiotics have surfaced in waters in USA, Canada and Europe and the fear of the possible development of bacterial resistance is fueling the movement to quantify these compounds and assess their effects. The present research involves the use of microscale membrane extraction as a simple and fast method for the extraction and analysis of these compounds. We show the extraction and monitoring of acidic and neutral pharmaceutical compounds, such as, ciprofloxacin, sulfamethoxazole, clarithromycin and trimethoprim. These antibiotics are used to treat a wide range of common ailments including upper and lower respiratory tract infections, pneumonia, tonsillitis, gonorrhea and sinusitis. Analysis and detection were done with HPLC-UV and enrichment factors as high as 1200 were obtained. RSDs ranged between 1.5 and 2.0% and detection limits as low as 92 ppt were obtained.